Research Statement

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My Philosophy of Research

My research focuses on the development of new theory, methodology and their applications to help understand massive and complex geospatial and non-spatial data. The new insights and knowledge acquired will help to better support decision and policy making. These research interests are guided by my belief that it is my responsibility and duty to pursue, capture, discover, create, and share knowledge about the way that data both geospatial and non-spatial, are captured, managed, used, visualised, analysed and communicated. The purpose and result of this is to enable me to translate what I have learned into information that can be disseminated and reproduced via professional publications (both academic and practice), conferences and correspondence (i.e. blog, e-mail, etc), to my students both in and out of the classroom, the university and the broader community.

My present research interest and professional practice lies in the following areas:

- Leveraging the power of geospatial analytics to enhance decision intelligence
- Data discovery using interactive and visual analytics tools
- Data analytics for data-driven decision support
- Democratising data with open source web-based analytics applications

Leveraging the power of geospatial analytics to enhance decision intelligence

In this globalising and competitive business environment, the value of location as a business measure is fast becoming an important consideration for organisations. Geospatial Analytics Techniques with its capability to manage, display, analyse and model business information spatially is emerging as a location intelligence tool. My research is to spatially enable conventional government and business information system. This will allow business and public policy decision maker to leverage on the power of geospatial analytics techniques to enhance decision intelligence. I am especially interested in exploring various approaches that integrate geographical information with spatial statistics and spatial modelling techniques. This includes the loose-coupling and tightly integrated. In recent year, I am particularly interested in exploring new R packages and algorithms specially designed for analysing geospatial data and applied these newly created packages or methods in real world cases.

By and large, the research outputs to-date are either in the form of consultancy projects, conference papers, conference presentations and invited speeches. In 2019, I have two major publications in this track one is a journal article entitle "*Do grant funding and pro-environmental spillovers influence household hazardous waste collection?*" published in **Applied Geography** and a book chapter entitle "*Exploring and Visualizing Household Electricity Consumption Patterns in Singapore: A Geospatial Analytics Approach*" in *Information in Contemporary Society*. Both papers represent my latest research on applying geospatial analysis techniques for public policy analytics with open and official data.

The paper on Household Electricity Consumption Patterns in Singapore has been well-received by the research comminute. According to Ink@smu, as at 28th December 2021, it already received a total of 961 downloads since June 13, 2019.

Journal Articles (Refereed)

- "Do grant funding and pro-environmental spillovers influence household hazardous waste collection?", by Kustini Lim-Wavdea, Robert J. Kauffman, Tin Seong Kam, & Gregory S. Dawsond (2019) Applied Geography, Vol 109. https://doi.org/10.1016/j.apgeog.2019.05.009

- "The use of geospatial clustering in analysing health risk profile", by Sue-Mae, Yeo; KAM, Tin Seong; Kai Xin, Thia; Dan, Wu. (2014). *Annals of the Academy of Medicine, Singapore, 43* (9), S32-S32. (Published)

Conference Papers (Refereed)

- "Exploring and Visualizing Household Electricity Consumption Patterns in Singapore: A Geospatial Analytics Approach", by TAN, Yong Ying and KAM, Tin Seong (2019). *Information in Contemporary Society: 14th International Conference, iConference 2019, Washington, DC, USA, March 31–April 3, 2019, Proceedings*. Pp 785-796. https://doi.org/10.1007/978-3-030-15742-5_74

- "Is There Space for Violence?: A Data-driven Approach to the Exploration of Spatial-Temporal Dimensions of Conflict", by Vincent Z. W. Mack and KAM, Tin Seong (2018). *Proceedings of the 2nd ACM SIGSPATIAL Workshop on Geospatial Humanities*, Seattle, WA, USA, November 06, 2018. 1-10. Doi: 10.1145/3282933.3282935 or https://dl.acm.org/citation.cfm?doid=3282933.3282935.

- "Location matters: Geospatial policy analytics over time for household hazardous waste collection in California", by LIM-WAVDE, Kustini; KAUFFMAN, Robert J.; KAM, Tin Seong; DAWSON, Gregory S. (2017). *iConference 2017: Proceedings*, Wuhan, China, March 22-25, (pp. 13-27) University of Illinois: iSchool. http://hdl.handle.net/2142/96678 (Published)

- "Interactive GeoVisual Analytic Tool (IGVAT)-A spatio-temporal multivariate data exploratory", by Tin Seong KAM, Adhyan ARIZKI, Nhu Ngoc CAO DANG, and LIM QIUHUI, 08/2009, 10, *Map Asia 2009*, Singapore.

- "Intelligent Road Network Routing Prototype for Singapore (Towards one NSDI)", by Tin Seong KAM, Hridaya Misra ADITYA, JI JUNYAO, and Tan CHEE YONG TIMOTHY, 08/2009, 10, Map Asia 2009, Singapore

- "GIS as a new Marketing Research tool", by Tin Seong KAM, 07/2007, 2007 INFORMS Marketing Science Conference, Singapore Management University, Singapore

Conference Presentation
- "Functional Programming and Parallelization in Spatial Point Pattern Analysis" by CHUA, Clara.; KAM, Tin Seong, 07/2021, *useR! 2021: The R Conference*.

- "Rich Internet GeoWeb for Spatial Data Infrastructure", by Tin Seong KAM, 10/2010, *Global Spatial Data Infrastructure 12 World Conference, Singapore*.

- "Demystifying Location Intelligence", by Tin Seong KAM, 08/2009, 15, *Map Asia 2009*, Singapore.

Consultancy Projects
- "Location Intelligence: Retail Banking Market Potential and Branch Locations Analysis in Vietnam" - an externally funded research project by Standard Chartered Bank via iLab. It was conducted and completed in AY2008. The outputs of this project include a report and an online location intelligence system called OLIAS. The Vietnam OLIAS is currently used by the bank to identify strategic locations to build new branches in Vietnam and also to estimate potential revenue of these new branches.

- "RIBA: Rich Internet Bio-diversity Atlas" for National Parks Board (NParks) Singapore. The project was completed and officially launched in 28 January 2011.

Invited Academic Talks, Lectures and Panels
- "TwitterSense: GeoVisual Analytics for Gaining Insights from Spatially-referenced Social Media", by Tin Seong KAM, 2011, 12 *Geospatial Information and Technology Exchange Forum* GITEX 2011, Singapore.

- "Building Appropriate Geospatial Enabled Analytical Tools for Businesses Intelligence", by Tin Seong KAM, 10/2008, *Leveraging the Power of Geospatial Analytics for Business Intelligence, SAS-SMU*, Singapore

- "Infusing GeoIntelligence and GeoAnalytics skills to business IT students", by Tin Seong KAM, 07/2008, *Geospatial Information and Technology Exchange Forum (GITEX) 2008*, Singapore.

Newspaper and Magazine Articles
- "Mapping Better Business Strategies with GIS (Geographic Information Systems)" by Tin Seong KAM, 2007, *Knowledge@SMU*

Data discovery using interactive and visual analytics tools

My interest in interactive and visual analytics started ten years ago when I was supervising a PhD research on the integration of GIS and Geovisualisation techniques for regional development planning. The system was designed using tcl/tk. Since early 2008, this interest has been extended to analyse large business data to complement the traditional business intelligence system. More specifically, I am interested in designing and implementing interactive and visual analytics tools that facilitates exploratory analysis of corporations' data warehouses with rich hierarchical structure, such as those stored in data cubes.

The journey of venturing into a new turf is usually not easy. This is because I need to re-learn a new scientific area, research on a vast volume of past literature and at the same time to keep up with the latest development. All thanks to the assistance and advices provided by the visual analytics professionals from both the academic and practice, I managed to jump-start and produced two notable research outputs. They are:

- "Parallel Sets in the Real World: Three Case Studies" submitted to *IEEE VisWeek Discovery Exhibition 2009*, one of the most prestigious international events for the data visualisation community. The submission received the Excellent Presentation Award of the competition.

- "Developing and Applying a User-Centered Model for the Design and Implementation of Information Visualisation Tools", *Information Visualisation (IV), 2011 15th International Conference on*. This is the European equivalent of IEEE VisWeek on the United States of America. The paper was very well-received. According to Google Scholar, it had been cited 40 times since 2011.

In 2019, one of my joint submissions with the MITB (Analytics) students taking ISSS608 Visual Analytics and Applications that I taught, won at the prestigious 2019 IEEE Visual Analytics Science and Technology (VAST) Challenge.

- "Interactive Visual Analytics Application for Radiation Surveillance", by Xie Weiyi and Kam Tin Seong, **VAST Challenge 2019 Mini-Challenge 2 Honorable Mention for Strong Analysis using Commercial Tools Award**.

This is the third consecutive year my joint submissions with the MITB (Analytics) students had won VAST Challenge award.

I was also invited to share my thought with the IT and business professionals in conference and forum.

- "Show Me the Numbers: Visual Analytics for Insights", by Tin Seong KAM, 07/2010, *INFOCOMM Professional Development Forum*, Singapore.

- "Interactive & Visual Analytics: Mastering the information Age", by Tin Seong KAM, 07/2008, *SAS Forum 2008*, Singapore.

Data analytics for data-driven decision support

Data analytics, a process of collecting, integrating, tidying, wrangling, analysing and communicating data sets from multiple sources to support the decision making process, is attracting significant interest by both businesses and public agencies. My research interest mainly focuses on applying appropriate data analytics techniques (both statistical learning and machine learning) to gain insights from massive and complex multiple sources data. These data includes those collected and stored in conventional customer relationship management (CRM) systems and social mediated technologies such as Facebook, Twitter and LinkedIn. By and large, these research are practice industry related consultancy projects. Thus, I am also keen to share the best practices and experiences gained from these projects to managers, students and policy makers. For example, one of the research projects that I worked with my students was cited in UBS's Q-Series Report entitled "*Can social network analysis enhance strategies following trading by corporate insiders?*"

Since 2010, I have been promoting R tidyverse and tidymodels framework in data analytics. Together with my MITB Capstone Project supervisee, we presented our latest work entitle "[Navigating Insurance Claim Data through Tidymodels Universe](#)" at *useR! 2021: The R Conference*.

I had also published one paper in a refereed journal, two short articles, one for Singapore Medical Journal and the other one for The Business Times. I was also invited to present in three forums and one academic talk. The details of these research outputs are given as follow.

Journal Articles [Refereed]

- "Time-series data mining in transportation: A case study on Singapore public train commuter travel patterns", by LEE, Roy Ka Wei; KAM, Tin Seong. (2014). *International Journal of Engineering and Technology, 6* (5), 431-438. http://dx.doi.org/10.7763/ijet.2014.v6.737 (Published)

This paper is one of the most well-read paper. According to Ink@smu, as at on 28th December 2021, it received a total of 2337 downloads since January 26, 2015.

Conference Paper

- "Knowledge Discovery from Multi-sources Healthcare Informatics", by Tin Seong KAM, Sharma JUHI, Wong TACK KEONG MICHAEL, and Asokan LAVANYA, 10/2012, 6, *7th INFORMS Workshop on Data Mining and Health Informatics*, Phoenix, USA.

Other Published Articles

- "Effect of user perception and feedback on satisfaction with the electronic medical records system", by Tin Seong KAM, Juhi SHARMA, Tan Y P, and Wu DAN, 08/2012, 53, 4, *Singapore Medical Journal*, Singapore.

Newspaper and Magazine Articles

- "Embracing analytics for a better competitive edge", by Tin Seong KAM, 07/2012, *The Business Times*.

Conference Presentations

- "Time-Series Data Analysis of Flight Delays at US Airports, January-June 2020", by Aishwarya Krishna Prasad; YAN, Ruiyun.; ZHONG, Linli Zhong.; and KAM, Tin Seong., *JMP Discovery Summit Americas 2021*.

- "Latent Class Analysis for identifying subclasses of Depression using JMP Pro 16", by Karishma Yadav, SEET, Fei Fei Sue-ann.; TAN, Yi Ying.; KAM, Tin Seong. *JMP Discovery Summit Americas 2021*.

- "A Journey through the Spatial Data Mining and Geographic Knowledge Discovery Jungle", by Tin Seong KAM, 2011, *SAS Business Analytics Forum 2011*, Singapore.

- "Getting to Know Social Media Analytics", by Tin Seong KAM, 2011, *INFOCOMM Professional Development Forum*, Singapore.

- "Rediscovering the Truth of Analytics", by Tin Seong KAM, 08/2010, *SAS Forum SG 2010*, Singapore.

Invited Academic Talks, Lectures and Panels
- "[How Modern Data Science Could Complement Actuarial Science in Claim Cost Estimation](#)", by Jun Haur, LOK and Tin Seong, KAM. 04/2021, *Virtual SAS Afternoon Forum*, Singapore Actuarial Society (SAS).

- "Empowering the Everyday Data Analyst", by Tin Seong KAM, 12/2009, 25, *SAS-SEIL Seminar Series*, Singapore.

Democratising data with open source web-based analytics applications

In general, the analysis functions provided by the commercially available GIS software tend to focus on basic geoprocessing functions such as buffering, overlaying, spatial aggregation, spatial join, and network analysis. It is beyond the scope of work and interest of GIS vendors to provide specific analytical and modeling techniques specifically for business applications. In view of this gap, I have been actively researching on integrating appropriate analytical methods and models within a GIS environment. For example, I had designed and developed ESPAN, an Exploratory Spatial Point Analysis for the National Environmental Agency (NEA) to detect hot spot areas of dengue fevers, to identify potential cluster, and visualising spatio-temporal event records. Up until 2015, my research interest tends to focus on designing and implanting web-based geospatial analysis and geovisual analytics applications by integrating open source technology such as OpenLayers, GeoServer, D3.js, R and Python-based geospatial analysis library or APIs. From 2015 onwards, my research interest tends to focus on the use of R Shiny as the web application framework and have extended the application areas beyond geospatial analytics to broader data analytics including statistical learning, machine learning and deep learning.

Journal Article (Refereed)
- "DIVAD: A Dynamic and Interactive Visual Analytical Dashboard for Exploring and Analyzing Transport Data", by Tin Seong KAM, Barshikar KETAN DILEEP, and Jun Hua, Shaun TAN, 11/2012, 71, *World Academy of Science, Engineering and Technology Journal*, World Academy of Science, Engineering and Technology, pp. 834-839.

This paper has been receiving a lot of readerships. According to the record of Ink@smu, as at 28th December 2021, it had received a total of 1245 downloads since March 15, 2013.

Conference Presentations
- "Integrating Apache Spark and R for Big Data Analytics on solving geographic problems", Zhang Mengqi and KAM TIN Seong, *FOSS4G 2017*, Boston. August 14-19, 2017.

- "A Journey through the Spatial Data Mining and Geographic Knowledge Discovery Jungle", by Tin Seong KAM, 2011, *SAS Business Analytics Forum 2011*, Singapore.

Invited Academic Talks, Lectures and Panels

- "Democratising Geospatial Data Science and Analytics with R Shiny App", by Tin Seong KAM. 9/2021, *Regional Geospatial Youth Forum - GeoEducation II*, Singapore.

- "TwitterSense: GeoVisual Analytics for Gaining Insights from Spatially-referenced Social Media", by Tin Seong KAM, 2011, 12 *Geospatial Information and Technology Exchange Forum* GITEX 2011, Singapore.

- "Building Appropriate Geospatial Enabled Analytical Tools for Businesses Intelligence", by Tin Seong KAM, 10/2008, *Leveraging the Power of Geospatial Analytics for Business Intelligence, SAS-SMU*, Singapore.

- "Infusing GeoIntelligence and GeoAnalytics skills to business IT students", by Tin Seong KAM, 07/2008, *Geospatial Information and Technology Exchange Forum (GITEX) 2008*, Singapore.